WHAT IS CLAIMED IS:

1. A method for producing a synthetic quartz glass member for excimer lasers, which, in a method for producing a synthetic quartz glass member for excimer laser optics comprising a step of incorporating hydrogen molecules into a synthetic quartz glass body by heat treating the synthetic quartz glass body at a temperature of 600 °C or lower under an atmosphere in a pressure range of 1 atm or higher but lower than 150 atm and containing hydrogen, said method comprises varying the pressure of the gas containing hydrogen either continuously or stepwise in at least a part of the heat treatment.

2. A method for producing a synthetic quartz glass member for excimer lasers as claimed in Claim 1, wherein the pressure of the gas containing hydrogen is decreased.

3. A method for producing a synthetic quartz glass member for excimer lasers as claimed in Claim 2, wherein the synthetic quartz glass body is heat treated under an atmosphere containing hydrogen for a first predetermined time duration under a pressure of first setting, and is further heat treated for a second predetermined time duration under a pressure of second setting that is lower than said pressure of first setting.

4. A method for producing a synthetic quartz glass member for excimer lasers as claimed in one of Claims 1 to 3, wherein the atmosphere containing hydrogen consists of 100 % gaseous hydrogen or a mixed gas containing hydrogen together with nitrogen, argon, or helium.

5. A method for producing a synthetic quartz glass member for excimer lasers as claimed in one of Claims 1 to 4, wherein the synthetic quartz glass body in which hydrogen is incorporated is prepared by either a direct flame hydrolysis method or an indirect flame hydrolysis method.

6. A synthetic quartz glass member for excimer lasers produced by a method for producing a synthetic quartz glass member for excimer lasers as claimed in one of Claims 1 to 5,

in which hydrogen is uniformly incorporated therein.

7. A synthetic quartz glass member for excimer lasers as claimed in Claim 7, wherein the difference between minimum value and maximum value in the density of hydrogen molecules is within the range of $\pm 1.2 \times 10^{18}$ molecules/cm^3.

8. A synthetic quartz glass member for excimer lasers as claimed in Claim 6 or 7, wherein, in case an ArF excimer laser radiation is irradiated thereto for a repetition of 2×10^5 pulses with an energy density per pulse of 2 mJ/cm^2 at a frequency of 200 Hz, the member yields an induced absorption under an irradiation wavelength of 215 nm of 0.003 or lower as expressed by absorbance for a thickness of 1 cm.

9. A synthetic quartz glass member for excimer lasers as claimed in Claim 6 or 7, wherein, in case a KrF excimer laser radiation is irradiated thereto for a repetition of 2×10^5 pulses with an energy density per pulse of 100 mJ/cm^2 at a frequency of 200 Hz, the member yields an induced absorption under an irradiation wavelength of 210 nm of 0.0075 or lower as expressed by absorbance for a thickness of 1 cm.

10. A synthetic quartz glass member for excimer lasers as claimed in one of Claims 7 to 9, wherein, under a radiation of 632.8 nm, it yields a homogeneity in refractive index of $\pm 4 \times 10^{-6}$ (/cm) or lower and a birefringence of 2 nm/cm or lower.

11. A method for producing a synthetic quartz glass member said method comprising:

a step of incorporating hydrogen molecules into a synthetic quartz glass body by heat treating the synthetic quartz glass body at a temperature of 600 °C or lower in an atmosphere in a pressure range of 1 atm or higher but lower than 150 atm, said atmosphere containing hydrogen,

the pressure of the atmosphere containing hydrogen being varied either continuously or stepwise in at least a part of the heat treatment.

12. A method for producing a synthetic quartz glass member as claimed in Claim 11, wherein the pressure of the gas containing hydrogen is decreased.

13. A method for producing a synthetic quartz glass member as claimed in Claim 12, wherein the synthetic quartz glass body is heat treated under the atmosphere containing hydrogen for a first predetermined time duration under a first pressure setting, and is further heat treated for a second predetermined time duration under a second pressure setting that is lower than said first pressure setting.

14. A method for producing a synthetic quartz glass member as claimed in Claim 11, wherein the atmosphere containing hydrogen consists of 100 % gaseous hydrogen or a mixed gas containing hydrogen together with nitrogen, argon, or helium.

15. A method for producing a synthetic quartz glass member as claimed in Claim 12, wherein the atmosphere containing hydrogen consists of 100 % gaseous hydrogen or a mixed gas containing hydrogen together with nitrogen, argon, or helium.

16. A method for producing a synthetic quartz glass member as claimed in Claim 13, wherein the atmosphere containing hydrogen consists of 100 % gaseous hydrogen or a mixed gas containing hydrogen together with nitrogen, argon, or helium.

17. A method for producing a synthetic quartz glass member as claimed in Claim 11, wherein the synthetic quartz glass body in which hydrogen is incorporated is prepared by either a direct flame hydrolysis method or an indirect flame hydrolysis method.

18. A synthetic quartz glass member produced by a method as claimed in Claim 11, said synthetic quartz glass member having hydrogen uniformly incorporated therein.

19. A synthetic quartz glass member produced by a method as claimed in Claim 14, said synthetic quartz glass member having hydrogen uniformly incorporated therein.

20. A synthetic quartz glass member produced by a method as claimed in Claim 17, said synthetic quartz glass member having hydrogen uniformly incorporated therein.

21. A synthetic quartz glass member as claimed in Claim 18, wherein the synthetic quartz glass member has a minimum value and a maximum value of density of hydrogen molecules therein with a difference therebetween that is less than 1.2×10^{18} molecules/cm^3.

22. A synthetic quartz glass member as claimed in Claim 19, wherein the synthetic quartz glass member has a minimum value and a maximum value of density of hydrogen molecules therein with a difference therebetween that is less than 1.2×10^{18} molecules/cm^3.

23. A synthetic quartz glass member for excimer lasers as claimed in Claim 18, wherein the synthetic quartz glass member yields an induced absorption under an irradiation wavelength of 215 nm of 0.003 or lower as expressed by absorbance for a thickness of 1 cm when an ArF excimer laser radiation is irradiated thereto for a repetition of 2×10^5 pulses with an energy density per pulse of 2 mJ/cm^2 at a frequency of 200 Hz.

24. A synthetic quartz glass member for excimer lasers as claimed in Claim 21, wherein the synthetic quartz glass member yields an induced absorption under an irradiation wavelength of 215 nm of 0.003 or lower as expressed by absorbance for a thickness of 1 cm when an ArF excimer laser radiation is irradiated thereto for a repetition of 2×10^5 pulses with an energy density per pulse of 2 mJ/cm^2 at a frequency of 200 Hz.

25. A synthetic quartz glass member for excimer lasers as claimed in Claim 18, wherein the synthetic quartz glass member yields an induced absorption under an irradiation wavelength of 210 nm of 0.0075 or lower as expressed by absorbance for a thickness of 1 cm, when a KrF excimer laser radiation is irradiated thereto for a repetition of 2×10^5 pulses with an energy density per pulse of 100 mJ/cm^2 at a frequency of 200 Hz.

26. A synthetic quartz glass member as claimed in Claim 21, wherein said synthetic quartz glass member has a homogeneity in refractive index of $\pm 4 \times 10^{-6}$ (/cm) or lower and a birefringence of 2 nm/cm or lower under a radiation of 632.8 nm.

27. A synthetic quartz glass member as claimed in Claim 22, wherein said synthetic quartz glass member has a homogeneity in refractive index of $\pm 4 \times 10^{-6}$ (/cm) or lower and a birefringence of 2 nm/cm or lower under a radiation of 632.8 nm.

28. A synthetic quartz glass member as claimed in Claim 23, wherein said synthetic quartz glass member has a homogeneity in refractive index of $\pm 4 \times 10^{-6}$ (/cm) or lower and a birefringence of 2 nm/cm or lower under a radiation of 632.8 nm.

29. A synthetic quartz glass member as claimed in Claim 24, wherein said synthetic quartz glass member has a homogeneity in refractive index of $\pm 4 \times 10^{-6}$ (/cm) or lower and a birefringence of 2 nm/cm or lower under a radiation of 632.8 nm.

30. A synthetic quartz glass member as claimed in Claim 25, wherein said synthetic quartz glass member has a homogeneity in refractive index of $\pm 4 \times 10^{-6}$ (/cm) or lower and a birefringence of 2 nm/cm or lower under a radiation of 632.8 nm.